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# Measuring the Return on Household Enterprise: What Matters Most for Whom?

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**Abstract** Return on assets (ROA) from household enterprise is crucial for understanding the well-being and productivity of households in developing economies. Yet the definition and measurement of household enterprise ROA remain inconsistent or unclear. We illustrate potential measurement problems with examples from various actual surveys. We then take advantage of a detailed integrated household survey to perform a robustness analysis, acting as if we had gathered less data than was actually the case, to see what matters and for whom. The three issues that matter most for accurate measurement of household enterprise ROA are the choice of accrual versus cash basis of income, the treatment of household's own labor in enterprise income, and the treatment of non-factor income. Also, this sensitivity matters most for a relatively poor region dominated by crop cultivation relative to a richer region with non-farm enterprises. Though the choice between accrued income and cash income matters less when the frequency of the data declines, there remains high sensitivity in longer-term and annualized data. We conclude the paper by providing recommendations on how to improve the survey questionnaires for more accurate measurement in field research.

**Keywords:** Return on assets, Household enterprise, Measurement, Income, Assets, Survey, Questionnaire design

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## 1. Introduction

Household enterprises are important in developing economies where many households are engaged in both farm and non-farm production. An enterprise operated by a household plays two separate yet related roles in the economy. It directly generates revenues to the operating household. It also creates an employment opportunity to other people in the economy, and provides labor income to those who may not operate their own enterprise. Income from household enterprises is often an important source of income used to finance consumption. Thus, understanding the performance and productivity of household enterprises is necessary for understanding of economic well-being.<sup>2</sup>

In this paper, we focus on a key variable that is important in the study of productivity of household enterprises, namely, the return on household enterprise as measured by the rate of return on enterprise assets (ROA). The ROA measures how well the enterprise utilizes assets to generate profits. For creditors or investors, this widely used productivity measure helps them make lending or investment decisions, comparing the return on assets as an assessment of likely repayment or against the opportunity cost of capital. Banerjee and Duflo (2005) review an extensive literature on the returns to investment and interest rates in poor countries, suggesting that return on assets is crucial for the understanding of the performance of credit markets and resource allocation in developing countries. Also, for policymakers, productivity measures help them prioritize policies that better target poverty; there is a vast of literature on microfinance that advocates an increase in access to capital for the poor (Morduch 1999, for example).

### *1.1 The Measurement Problems*

To begin a study of the productivity of household enterprises, one must define what a household enterprise is. Empirical studies in industrial organization and corporate finance usually rely on the legal definition of a firm as a collection of physical and financial assets, and this is consistent with the theoretical notion of a firm proposed by Hart (1995). Several studies of household

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<sup>2</sup> Some studies define a household enterprise as a non-farm business enterprise operated by the household (Vijverberg and Mead, 2000). In this paper, we define a household enterprise broadly as any production enterprise, both farm and non-farm, that is run by the household.

enterprise in development economics also adopt this definition of the firm, at least implicitly, analyzing the investment, financing, and returns of enterprise assets. However, researchers in development economics cannot rely on the legal definition of a firm commonly used by scholars in industrial organization or corporate finance as the majority of household businesses in developing economies are not formally registered. Further, income generated by the physical and financial capital of household enterprises (i.e. profits, rents, and interests) cannot be easily disentangled from income generated by the human capital of household members (i.e. wage earnings). These businesses are also not protected by limited liability, and household assets and business assets are legally indistinguishable, as they are shared between household and business uses.

An unclear definition of household enterprise leads to complications in the measurement of income and assets and therefore in calculating the rate of return of household businesses. Indeed, various household and enterprise surveys define and measure them differently. Worse, several surveys are inconsistent internally in dealing with the problem across different questions within the same survey. Of course these issues are not new. Deaton (1997) devotes a large part of his seminal book on the analysis of household surveys to a discussion of the difficulty in designing and using data from household surveys. Similarly, in one of the most comprehensive studies on household enterprise surveys, Vijverberg and Mead (2000) raise concerns regarding the measurement of household enterprise revenues and expenditures and provide suggestions on questionnaire design. They emphasize, for example, the distinction between the purchase and the use of inputs, and between the sale and the production of outputs. They then suggest that researchers focus on the use and output rather than the purchases or sales when studying the production and performance of household enterprises. Our paper is similar in spirit to this literature. Armed with a conceptual framework on household financial accounting developed in Samphantharak and Townsend (2010), we revisit in more detail some of the measurement issues that are common to the study of household enterprise.

Naturally, the first issue is how to make the distinction between a household and its business enterprise. Although household and enterprise surveys generally consider consumption of a household's own output as a part of the enterprise's output and revenue, several surveys do not

consider the household's own labor in the cost of production. This asymmetric treatment of the household's activities raises a key conceptual issue: whether researchers are consistent in drawing a distinction between the household on the one hand and its business enterprise on the other when analyzing their behavior and performance. Another related issue is how to allocate expenses (such as utility bills) and assets that are jointly used for both consumption and business purposes. This problem is better known among researchers, and the issue is a practical rather than conceptual one.

The second concern that we discuss in this paper is the treatment of non-labor income such as gifts and transfers, which are prominent in developing economies with dense social networks or government social programs. The treatment of gifts and transfers is not consistent in many household and enterprise surveys. Some surveys ignore or are not clear whether outputs given away to others (without receiving cash or other in-kind payments in return) are included in the household enterprise's outputs. Some surveys are explicit that outputs given away are a part of total output but do not directly address whether the inputs a household received for free (such as fertilizer, seeds, or animal feeds from the government) are included in the calculation of total cost of production. Again, this issue is conceptual. The asymmetric treatment of gifts and transfers on the output (revenue) and the input (cost) sides suggests that the problem has not been faced squarely.

Third, we consider the issues that arise when a household engages in activities that take several months to complete. Cash income and accrued income of a household enterprise could be different. Cash income refers to the revenues and expenses of the enterprise as it receives or spends cash. For accrued income, however, revenues and costs are charged when the enterprise sells the outputs, and this is what is typically used in the measurement of productivity, an attempt to capture the overall project return. This timing distinction is important for households in developing countries, where cultivation and livestock farming are common household activities, inventories are important, and trade credit can contribute to a large share of their working capital. Some household and enterprise surveys seem unclear about this distinction.

Finally, there is the issue of how to treat current assets such as cash, financial assets, and inventories. These current assets could also contribute to the income generating activities of household enterprises. Thus, depending on the purpose of the study, researchers sometimes focus on the return on total assets, fixed assets, or other particular assets. For example, McKenzie and Woodruff (2008) conduct a cash transfer experiment in Mexico and look at the overall return on capital. Kremer, Lee, and Robinson (2008) study the rate of return to inventories for retail businesses in Kenya. Duflo, Kremer, and Robinson (2008) focus on the rate of return to fertilizer for Kenyan farmers. Udry and Anagol (2006) estimate the overall internal rate of return to capital for a new technology of pineapple cultivation in Ghana. We stress that it is important for researchers to be clear in which enterprise assets they are interested and how they define those assets. For those comparing rates of returns from different studies it is important to verify that same definition of the return is used if possible.

There is one important caveat. Although we critique some of the survey questionnaires of others, we recognize that overall these same surveys are of high quality, and that the researchers were careful about questionnaire design. The surveys do ask many useful questions and the problematic questions that we focus on here represent only a small part. Perhaps, some of the questions unclear to us as the users of the surveys were well understood by the survey designers and the interviewers. Finally, we acknowledge that the Townsend Thai Project surveys that we use in this study are also not perfect either. That said, we believe that the measurement issues we critique and rank order in this paper, especially those at the top of our list, should not be ignored in future work, of others as well as our own.

## ***1.2 What We Do***

To raise any issue might suggest that the way to deal with it is to do better, asking for more and more information, with improved wording in the questionnaires. Yet questions can grow in length and complexity as each issue is treated in more detail. In practice, time and financial resources constrain the detail of questionnaires and researchers must make decisions about which questions to include, how to ask them, and which questions to drop. Here, we set out to explore which issues matter the most in the measurement of the household enterprise rate of return, and

for which type of households. That is, we intend to provide guidance on where time, effort, and precision is needed and where it is likely not worth the trouble. Thus we try to be realistic, and helpful, about the choice confronting researchers. When we identify an issue that is toward the bottom of our priority list, it does not mean that better measurement is not needed or that the issue does not matter. Discrepancies can be large. Rather, our message is that a focus on that issue typically comes at the expense of something else where the discrepancies are even worse. It is the tradeoff that is our focus here.

We take advantage of a detailed integrated household survey that has generated many months of panel data. The length of the panel, the unusual level of detail, and the creation of an overall accounting framework allow us to perform sensitivity analyses, or robustness checks, acting as if we had gathered less data than was actually the case, or asking the question one way and not another. Specifically, we examine the sensitivity of the rate of return when enterprise income and assets are defined differently, using the sampled households from the Townsend Thai Monthly Survey. The issues discussed in this paper include the household's own labor, consumption of the household's own product, common expenses from both consumption and production activities, assets jointly used for both consumption and production purposes, gifts and transfers, accrual versus cash basis of income, and various definitions of enterprise assets. As discussed earlier, some of the issues are associated with conceptual problems (how to define enterprise income or assets) while others are practical problems (how to measure enterprise income or assets).

There is another caveat. We compute the return on assets using different definitions of business income and assets for household enterprises drawn from a single survey instrument. One potential concern with what we do is that the very act of asking one question affects responses to other questions. If this is the case, then it may not be valid to use the single survey we use to inform researchers about what answers would have looked like, if they used a shortened questionnaire.

Our study contributes to a growing literature on how to define and measure key variables in development economics. Beegle, de Weerd, Friedman, and Gibson (2009) conduct an

experiment of the measurement of consumption in Tanzania, using eight alternative consumption questionnaires randomly distributed across households. Relatedly, Dillon, Bardasi, Beegle, and Serneels (2010) present the results from a randomized survey experiment in Tanzania focusing on different questionnaire designs that classify child work and proxy response versus self-reporting. Beaman and Dillon (2010) conduct a randomized survey experiment of four different household definitions in Mali to examine the implications for household-level statistics. In all of these studies, the researchers found that various definitions of the key variables matter for the measurement and subsequent outcomes of the analysis of household behavior matters.

### ***1.3 What We Find***

The three issues that matter most for measurement of household enterprise return on assets are the choice of accrual versus cash basis of income, the treatment of the household's own labor in calculating enterprise income, and, especially for households in the region with dense social networks, the treatment of non-factor income. Other issues also matter, that is, they are quantitatively large, but on a relative scale, matter less. The relative ranking across our various exercises is similar for enterprises in both the less agricultural, semi-urban, relatively richer region, and the mostly agricultural, rural, relatively poorer region. Second, although the ranking is similar for both regions, the magnitude of the sensitivity is higher for the relatively poor region dominated by crop cultivation than for the richer region with non-farm enterprises. Finally, although the choice between accrued income and cash income matters less for ROA when the frequency of the data declines, even with annualized data the choice between these two concepts of income seems to matter. That is, if the changes in account receivables, account payables, and inventories of the enterprise are not canceled out within a year, then the discrepancy between cash and accrued incomes remains, raising an alarm for even annual cross-sectional surveys that do not distinguish or are unclear about the two concepts. This can happen when there is an expansion of the business enterprise or when the enterprise changes its working capital management strategy. For example, the enterprise could extend or shorten the payment periods of its trade credit. Likewise, it could accumulate or decumulate the average holding of its inventory stocks.



The remainder of the paper proceeds as follows. Section 2 discusses in more detail various issues in measurement of household enterprise income and assets, hence ROA. We discuss ideal measures and give examples from actual survey questionnaires that illustrate how they deal with each issue (or lack thereof). Section 3 describes the data from the Townsend Thai Monthly Survey and the construction of various measures of household rate of return. Section 4 presents our empirical strategy and defines the metric we use in the sensitivity analysis, the normalized root mean squared deviation (RMSD). Section 5 discusses the analytical findings. Finally, we provide suggestions for future survey designs in Section 6.

## **2. Questionnaire Design and the Measurement of Return to Household Enterprise**

### ***2.1 Distinguishing the Household Enterprise from the Household***

As discussed earlier, the separation between the household business enterprise and the household itself is not clear. In this paper, we define household business enterprise as a collection of physical and financial assets, consistent with the traditional empirical definition in the study of firms in the industrial organization and corporate financial literatures. The income generated from household enterprise is therefore the income from the utilization of its assets. Likewise, the rate of return on household enterprise is the return on the assets of the enterprise. In order to make our measurement of household enterprise income, assets and rate of return consistent with those for firms in corporate sector, we do not include the household's wage earnings (both from external labor markets and from the household's own business enterprise) as a part of business income (and we do not include the household's human capital as a part of business assets).

#### ***2.1.1 Household's Own Labor***

First we emphasize the difference between household income and household enterprise income: the former measures the household's total income from all income generating activities, while the latter focuses on the household's production enterprises. Household income includes income from wage earning or other compensation to household human capital as well as income from the utilization of household assets (i.e. profits, rental income, and interest income). This measure

is useful when we study how well households generate income to finance their consumption and savings, and how variability in income affects the economic well-being. Household enterprise income, on the other hand, is useful when we examine how well households operate their businesses, both farm and non-farm. Household enterprise income is crucial for the study of business profitability, business expansion, and working capital management and is used in our calculation of household enterprise ROA.

In general, net income of a household enterprise is computed by subtracting the total costs of production from the enterprise's total revenues. The enterprise's total revenues are the revenues collected from the enterprise's production activities, excluding wages earned outside the household by household members. Total costs are defined as costs related to the enterprise's production activities, including materials, labor provided by non-household members, utility expenses, and depreciation of assets. Total costs also include an imputed cost for labor provided by household members. The difference between household income and household enterprise income therefore lies in part in the treatment of compensation for labor service provided by household members outside and inside the firm, both the wage earned from outside the household and the shadow costs of household labor provided to household's own enterprises.

Some of the surveys on households and household enterprises are careful about this distinction in the wording of the questionnaires. For example, in their study of the return to household enterprises in Sri Lanka, de Mel, McKenzie, and Woodruff (2009) ask "*What was the total income the business earned during March after paying all expenses including wages of employees, but not including any income you paid yourself. That is, what were the profits of your business during March?*" Some other surveys are less clear. For example, a question for farm business expenses in the Indonesia Family Life Survey 1993 reads "*What is the approximate amount in rupiah of total expense spent by the household for the farm business during the past 12 months?*" (Question UT08). A similar question was asked for non-farm business revenue (Question NT08). These questions raise a concern whether compensation to the household's own labor was treated as a cost.

### *2.1.2 Consumption of Household's Own Outputs*

It is common for agricultural households to consume crops grown on their own plots or animals raised on their own farms. In principle, the consumption of a household's own outputs must be treated as both consumption and production, as if the household produced and sold the product to the market, and then repurchased and consumed it.

Most household and enterprise surveys are aware of household consumption. Again, take the Indonesian Family Life Survey 1993, as an example. It clearly indicates that business revenues must include production for own consumption on the revenue side. Specifically, the question for farm business revenue reads *“What is the approximate amount in rupiah of total revenue received by the household from the farm business (including produce for own consumption) during the past 12 months?”* (Question UT07). A similar question was asked for non-farm business revenue (Question NT07). Another example is from the Living Standards Measurement Study (LSMS) survey. In a series of questions related to household enterprise revenue, the survey asks explicitly and separately: *“During the past 14 days, how much money has the business received from the sales of its products, goods or services?”*; *“What was the value of these transactions (the value of goods and services received as payment and the value of your own products that you used for payment) over the past 14 days?”*; and *“What was the value of the goods and services consumed by your household over the past 14 days?”*

The inclusion of consumption of the household's own outputs as a part of household enterprise's revenue from production activities, as discussed in this subsection, and the exclusion of household's own labor as a part of household's cost of inputs, as discussed in the previous subsection, raise the concern that some surveys may inconsistently treat the household's involvement in its production enterprise.<sup>3</sup>

### *2.1.3 Consumption versus Production Expenses*

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<sup>3</sup> However, if the purpose of a survey is to get total household income (as opposed to household enterprise income), then the income should include the consumption of household's own output, but exclude household labor as an input cost.

Unless a household enterprise separates its business expense account from its household expense account, categorizing household expenditures as consumption-related or as costs-of-production can be problematic. For example, part of a household's electricity bill is a household's consumption unrelated to the business enterprise and so should be treated as household consumption expenditure. The rest of the bill, however, is from the use of electricity in the production process at the enterprise and so should be treated as a cost of production. This is generally true for other utility expenses, as well.

Some of the household and enterprise surveys such as the LSMS survey ask explicitly in the enterprise module itself the expenses on utilities (electricity, gas, water, telephone bills, etc.) and take the answer estimated by the respondent as a business expense. Other surveys, including the Townsend Thai Monthly Survey, ask for the total expenses on utilities from all production and consumption activities, thus raising the problem on how to apportion the expenses between consumption and (each of the) production activities. Alternatively, in principle a survey could ask each household to apportion their expenses into consumption and production purposes although this begs the issue of whether the distinction is possible in practice. Finally, the researcher may make assumptions and apportion total utility expenses accordingly. In this case, the assumptions used should account for the type of production activity that an enterprise operates, as different activities use different amount of water, energy, and other utilities.

#### *2.1.4 Assets Used for Consumption Purposes*

Households typically use some of their fixed assets, especially those recorded in the household asset module of the questionnaire, in both consumption and production activities. Housing structures and vehicles are obvious examples. Similar to the issue of common expenses, common assets used in both consumption and production activities raise a concern. A survey may not be able to clearly distinguish the use of assets for production versus consumption purposes. For example, vehicles may be recorded as enterprise fixed assets but the service flows generated by these vehicles that contribute to household consumption are not generally recorded as outputs, resulting in an underestimated rate of return on assets. Similarly, the value of land usually

includes the value of housing structures built on the land, and parts (but not all) of the land and housing structure may be used exclusively for consumption purposes rather than production.

There are two approaches to deal with this issue. First, researchers may calculate and include consumption service flows from the assets to income. This approach is parallel to how typical household and enterprise surveys treat the consumption of household's own outputs described in Section 2.1.2. The second approach is to exclude the portion of assets used for consumption purposes from enterprise assets. This approach is parallel to the way an ideal survey should treat common expenses such as utility bills, as we described earlier in Section 2.1.3.

Both approaches share a common implementation difficulty. It is difficult, if not impossible, to distinguish the use of some assets in practice. Usually, a survey asks the same question about an asset to all sampled households. For example, a survey usually asks "How many cars (vehicles) do you own?" Some households may use their cars exclusively for consumption purposes; some may use them exclusively in their business enterprises; and many may use the cars for both activities. Even within the same household, the use of the cars could be different from period to period. One could envision that we could look at *each* household and classify or apportion *each* asset of the household based on its use in *each* period. For example, the LSMS Enterprise Module asks "*How many rooms of your residence do you use for your business during normal business hours?*". This is similar to what a tax authority such as the Internal Revenue Service (IRS) in the US asks, and allows, for the use of a portion of space in a residential structure as business property, hence as tax deductible. However, this kind of question is not generally asked in household or enterprise surveys and is very rarely asked for fixed assets other than residential structure and land.

## ***2.2 Non-Factor Income***

The income of a household or of its enterprise could come from two sources. First, the income could be compensation for the utilization of inputs that the household provides. These inputs include physical and financial assets (for both household and enterprise income) as well as human capital (for household income). This type of income is called factor income. The second

source of income, called non-factor income, is from gifts and transfers that the household or its enterprise receives from others without supplying inputs of production.<sup>4</sup>

### 2.2.1 Gifts and Transfers

Gifts and transfers contribute to the wealth of the household or its enterprise without being directly related to the production process. In this sense, their treatment deserves special attention when we calculate the income of a household and its enterprise.

In practice, the treatment of gifts and transfers is diverse. On the one hand, National Income and Product Accounts (NIPA) treat gifts and transfers received by a household as a part of the household's personal income. On the other hand, traditional corporate financial accounting does not treat gifts and transfers as income because they are not derived from production activities or compensation for inputs of production, and therefore do not reflect the productivity of the business enterprise. Although we realize that the treatment of gifts and transfers could depend on the purpose of each individual survey, we emphasize that the distinction is an important issue of concern in a developing economy where social networks and social programs play an important role in household businesses and their financing. Gifts among households in village economies or transfers from governments or other organizations could be large as compared to the factor income of household enterprises. Questionnaire design must be aware of this issue.

The treatment of gifts and transfers in some household and enterprise surveys seems unclear, however. Take the LSMS survey, as an example. The survey asks "*In a month with "average sales," how much have you spent in total on the purchase of inputs (labor, raw materials, items for resale, transport, electricity, water, fuel, rental, maintenance, taxes, registration fees, insurance, etc.)?"*" (Grosh and Glewwe, 2000). Several key definitional questions are left unclear:

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<sup>4</sup> In this paper, we treat gifts and transfers as non-factor income of the household enterprise. It is worth noting that gifts and transfers could alternatively be viewed as financing of the household enterprise, rather than income. As discussed in Samphantharak and Townsend (2010), parts of household assets may be financed by outsiders, either via debt or gifts. A non-altruistic gift provider, who naturally expects reciprocity, has implicit claims on household assets similar to the claims by a debt holder. However, the claims of the gift providers may have less seniority than the claims from the lenders and the members of the household (i.e. the "creditors" and the "shareholders" of the household enterprise, respectively). The gift providers have such low seniority that formal laws do not protect them and they may have to rely only on informal social punishment.

If the household received free fertilizer from the government, should this gift be included in the cost of production?

The farm business expense questionnaire from the Indonesian Family Life Survey 1993 that we quoted earlier in Section 2.1.1 raises similar concerns. Likewise, on the revenue side, some surveys are not clear whether the outputs given away to others for free should be included in its total revenue. One example is the LSMS survey questionnaire previously mentioned in Section 2.1.2. Being explicit about the definition of the variables of interest is therefore crucial for the inference and interpretation of the results when analyzing the data.

### *2.2.2 Labor Exchange*

Many agricultural households in developing economies are often involved in labor exchange or free labor transactions with individuals who are not members of the household. In principle, for the study of profitability of household enterprises, labor exchange and free labor transactions consist of two separate components. First, the help received by a household should be considered as a labor cost of production. Second, since the help received is free, we should consider the labor cost as being financed by a gift received. Specifically, free labor received by a household should be subtracted from the income of the household and its enterprise. At the same time, the gifts received should be considered as a part of a household's non-factor income.

Thus, ideally, when a labor exchange or free labor transaction is observed in a survey of households and their enterprise, we should ask for the equivalent monetary value of the transaction and record it as a labor cost of production and as a gift received. Most of the surveys, however, do not ask for this information. For example, the Townsend Thai Monthly Survey asks for labor exchange (in days and hours), but does not ask for the value (in baht) of the transaction. As a result, the factor income computed from the survey is likely to be overestimated for households who are net receivers of labor exchange.

## *2.3 Timing and Frequency*

### *2.3.1 Cash versus Accrued Income*

In corporate financial accounting, there are two approaches to calculating the income of business. The first approach is the cash basis, which looks at the revenues and expenses of the enterprise as it receives or spends cash. An alternative approach is the accrual basis, under which revenues and costs are charged when the enterprise sells or disposes of the output. Obviously, the accrued income method more accurately measures an enterprise's profitability in its use of assets since the revenues and the costs relate to the output from the same production activity. The same idea applies here to a household and its enterprise income. For each household or household enterprise, we can compute its cash income and its accrued income.

The issue is again related to how we separate cash revenues and costs between the household and its business enterprise arises, parallel to what we discussed earlier in Section 2.1. The treatment of some of the items is more obvious than others. For example, consumption of a household's own output is not a cash-related transaction. Outputs that are both produced and consumed by the household are not paid for and therefore are not literally a part of cash income from the household enterprise. However, if we suppose that a household were a separate entity from its enterprise, we could view consumption of the household's own output as a combination of two distinct transactions: one performed by the household enterprise and the other performed by the household itself. Specifically, the business enterprise first produced and sold the output in a village marketplace for cash, and then the household used cash to purchase the same output back from the marketplace. This could be appropriate if the focus is on current income rather than cash flow constraints per se. Likewise, a similar adjustment could be done for household labor supplied to the household's own enterprise. Unfortunately, the treatment of other items such as utility expenses are less clear, and the discussion in Sections 2.1.3 and 2.1.4 could be repeated here again.

After separating the cash income of the household enterprise from the household, remaining differences between cash and accrual approaches lie in business trade credits (i.e. sales of outputs but not yet having been paid, or purchases of inputs but not yet having paid out), movement in business inventories, depreciation of enterprise assets (i.e. a cost of production without actual



cash spending), and unrealized capital gains and losses from the assets (i.e. revenues and costs that have not been realized as cash transactions). Since typical households engage in activities that take several months to complete, we do not generally expect their cash income and accrued income to be equal, especially in high frequency survey data. This distinction is even more important in the case of households in developing countries, where cultivation and livestock farming are common household activities. Inventories could also play an important role, particularly for agricultural production, which has high fluctuations in input and output prices over the year. For retail businesses, trade credits contribute a share of their working capital. Even in a lower-frequency survey, such as an annual survey, accrued income and cash flow may still not coincide if the enterprise expands or downsizes its business, or changes its working capital management strategy. In this case, trade credits or seasonal inventory fluctuations may not cancel out over time.

Although questionnaire design should pay attention to these issues, they remain unaddressed in some of the household and enterprise surveys. For example, the LSMS questionnaire from the Albanian Institute of Statistics (2005) asks “*How much [...] did you use during the past cropping season?*” and “*How much did you spend in total for [...] during the last cropping season?*” (Module 12: Agriculture, Part D: Inputs, Questions 2-4). In other words, the survey asks about inputs used and the amount spent over a specified cropping season, equating the two. But for some households these are not equal. If households used inputs held in previous inventory, then expenditures during the specified season might be recorded as zero. Likewise, inputs purchased during the season may not have been used on the plot.

Revenue raises similar timing issues. The LSMS questionnaire from Reardon and Glewwe (2000) asks “*How much of the [...] you harvested during the last two cropping seasons was sold?*” and “*What price did you get for the [...] you sold?*” (Agricultural Module, Standard Version, Part C2: Disposition, Questions 3 and 4). In this case, the survey asks about the production during the past cropping seasons, and about the sale of any of that product. However, sales from earlier product inventory is typically not asked, or at least not clearly distinguished.

### *2.3.2 Depreciation, Unrealized Capital Gain and Loss, and Mark-to-Market versus Acquisition Values*

Panel data from household surveys typically experience prices changing over time. Researchers may choose to ask for the historical acquisition value of the assets or the current mark-to-market value of the assets. The debate on how to deal with assets with volatile market prices, or illiquid assets that are rarely traded, is not unique to household enterprises in developing economies. It is a contentious issue in the financial industry in the most developed economies, as well. There are some trade-offs here: conservative accounting practices value assets at acquisition costs, while mark-to-market valuation may be more appropriate when markets are thick and volatility is not excessive. Valuation of illiquid assets could be unreliable and vulnerable to subjective valuation. Mark-to-market valuation of assets with price fluctuations (such as inventories) may overstate or understate the return to household enterprises, especially if the survey is conducted only once and no time-series is available for the calculation of long-term average return.

Although the choice of an asset valuation strategy depends on the purpose of a study, researchers should be explicit in their survey questionnaires about how assets were valued. For example, de Mel, McKenzie, and Woodruff (2009) ask for information about the purchase of new assets, the disposition of assets by sale or damage, and the repair and return to service of any previously damaged assets. Changes in the market value of fixed assets are calculated from the responses to these questions. Their survey also collects the information on the current value of inventories of raw material, work in progress, and final goods each quarter. The Townsend Thai Monthly Survey updates the value of land when there is a major improvement that affects the value of that land, but it does not continuously adjust the market value of other fixed assets until they are sold, recording the cumulative increase (decrease) in value as a capital gain (loss) only at the time of the sales. The survey depreciates the value of fixed assets (excluding land) every period, despite an inevitably ad hoc assumption on the depreciation rate. Capital gains and losses of inventories raise similar concerns. The Townsend Thai Monthly survey does not adjust the value of inventories every period until they are sold. An exception is for unrealized gains and losses in livestock, which are adjusted when animals become mature or die. Alternatively, the LSMS survey asks explicitly “*If you wanted to sell [each asset] how much could you sell it for today?*”.

However, as mentioned above, valuation of illiquid assets could be subject to measurement errors and personal perception (Grosh and Grewwe, 2000).

## ***2.4 Various Types of Assets***

In addition to fixed assets, current assets such as cash, financial assets, and inventories also contribute to the income generating activities of household enterprises. Depending on the purpose of their study, researchers sometimes focus on return on total assets or return on a particular type of assets. For example, the LSMS survey usually asks for information about both fixed assets (land, building, equipment and machinery, furniture, small or large tools, vehicles, and other durable goods) as well as raw material and finished-goods inventory, but does not generally collect the information on financial working capital such as cash (Grosh and Glewwe, 2000). In their study of the return to capital in Sri Lanka using a randomized cash transfer experiment, de Mel, McKenzie, and Woodruff (2009) provide a detailed definition of assets, which include both fixed and working capital.

## **3. Data**

### ***3.1 The Townsend Thai Monthly Survey***

The data used in this study are from the Townsend Thai Monthly Survey, an on-going monthly survey initiated in 1998 in four provinces of Thailand. The provinces Chachoengsao and Lopburi are semi-urban provinces in a more developed central region near the capital city, Bangkok. The provinces Buriram and Srisaket provinces, on the other hand, are rural and located in a less developed northeastern region by Thailand's border with Cambodia. In each province, the survey is conducted in four villages and there are approximately 45 sampled households in each village. This monthly survey began with an initial village-wide census, where every structure and household was enumerated and "household" units were identified using sleeping and eating patterns. Further, all individuals, households and residential structures in each of the 16 villages can be identified in subsequent monthly responses. The survey itself began in August 1998 with a baseline interview of initial conditions in sampled households, and continued with monthly

updates starting in September 1998. The updates are used to track the inputs, outputs, and changing conditions of the households included in the baseline survey.<sup>5</sup>

The analysis presented in this paper is based on 84 months of data, which was the entire sample available at the time of the initial writing of this paper, starting from month 5.<sup>6</sup> The 84 months are from January 1999 through December 2005. Only the households that were surveyed throughout the 84 months are included in our study, and since we consider the income and assets of both the households and their enterprises, we also exclude from this study those households whose entire income in every period during the 84 months was from wage earnings. There are 486 households in the sample: 259 from the central region (121 from Chachoengsao, and 138 from Lopburi) and 237 from the northeastern region (102 from Buriram, and 135 from Srisaket). In total, we start with 21,756 and 19,908 household-month observations from the two regions in the sample. Table 1 presents the median of selected household characteristics.

[INSERT: Table 1]

As shown in Table 1, households in the central and the northeastern regions seem to share similar demographic characteristics. The median households in both regions have similar household size (averaged over 84 months) of approximately 4.5 members per household. Both seem to have more females (2.5) than males (2.0). Social networks, as defined by the number of extended families living in the same village, are denser in the northeast than the central region, 3 versus 2 extended families for the median household. The average age across household members (at the beginning of the survey in 1998) is slightly higher for the median household in

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<sup>5</sup> The detailed description of the survey can be found in Samphantharak and Townsend (2010).

<sup>6</sup> The main reason why we start at month 5 is that the lengthy baseline survey (month 0) took longer for some households than others, leading to the timing mismatch of the observations across different sampled households in the first two or three months. This discrepancy diminished after that, but to be conservative we start the analysis at month 5. Note also that the field enumerators in our survey also learned about some problems in the survey and how to fix them during this initial period. This is not the case for a cross-sectional survey, where the remedy is rigorous training of the field enumerators because they do not have the luxury of learning from earlier periods of the survey. (At the request of a reviewer, we have checked whether there is any difference in our results if we use all available observations, including the first four months. We find that the overall conclusions made in this paper still hold. The median statistics are largely similar to what we report in this paper, although some mean statistics change due to the outliers.)

the central region, 37.5 years versus 33 years for the northeast. Households in the central region also seem to have slightly higher average educational attainment.

The striking differences between households in the two regions are in economic characteristics. The median household in the northeast spends most of its time in cultivation activities (61% of the total time spent on all household enterprise activities combined), while the median household in the central region spends only one third of its time in cultivation. Households in the central region are also richer, with the median household having total assets and total wealth (assets net of liabilities) almost three times more than the median household in the northeast. Per capita income (monthly average across 84 months) of the median household in the central region is also 3.5 times higher than its counterpart in the northeast.

For each household, the survey gathers information about its business enterprise and production activities. The household and its business enterprise could hold various types of assets and engage in various types of production activities. In fact, many households in the Townsend Thai Monthly Survey are involved in multiple production activities, either over time or even within a given period. The survey classifies these activities into crop cultivation, retail business, livestock, and fish and shrimp farming. In this paper, we consider a consolidated household enterprise where income and assets from all production activities are aggregated. The aggregation is similar to what National Income and Product Accounts do, i.e. aggregating outputs from various sectors of the economy, using prices and a common currency unit as a numeraire. In other words, we view a household enterprise with multiple production activities as an entity similar to a multi-sector business conglomerate.

Of course, disaggregation of enterprise income and assets by type of business is useful, especially for the study of risk and diversification, since households may diversify their risks by participating in various production activities. Disaggregation is also useful for the study of specialization. Policymakers may be interested in knowing about who is good at what so that they can design and implement policies more effectively. Disaggregation of enterprise income and assets could be used to study the interactions and flows of goods and services within a village economy or between the village economy and outsiders, similar to what we learn from

input-output tables at the national level. Even though we abstract from the disaggregation issue in this paper, and treat a household with multiple production activities as a conglomerate-like enterprise, one can extend what we have discussed earlier on the separation of the household and its business enterprise to the issue of how to separate various production activities from one another within the household business conglomerate. For example, if we would like to separate crop production from livestock, we would face the problems of how to apportion the common assets between these two activities, how to apportion common utility expenses, and how to treat outputs of one activity as inputs in the other. These issues are parallel to how to treat household consumption of own outputs and how to treat household's own labor. In other words, the issues we raise in this paper could be extended and applied to the disaggregation of different activities within the household.

### ***3.2 Measures of Income, Assets, and Rate of Returns***

The rate of return on assets (ROA) is defined as monthly income divided by average monthly assets.<sup>7</sup> Table 2 presents our various definitions of income and assets. In order to study the return to household enterprise, we compute ten different measures of household enterprise income or household enterprise assets, and their associated ROA. As can be seen from the table, each individual definition of income and assets is different from the definition of income and assets for ROA 1 in just one aspect at a time. This strategy allows us to study the sensitivity of ROA when only one component of either income or assets is changed. The appendix presents the definition and construction of each measure of income and assets in detail.<sup>8</sup>

[INSERT: Table 2]

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<sup>7</sup> We annualize and present the ROA in percentage term. Specifically, for household enterprise  $i$  in period  $t$ , the rate of return is computed from

$$ROA_{i,t} = \frac{\text{Income}_{i,t}}{\text{Average Assets}_{i,t}} \cdot 12 \cdot 100\%.$$

Note that, in contrast to the marginal return frequently estimated in the existing literature, our measure of ROA is the average return. Therefore decisions about how to treat various types of assets, or assets which get used partly for consumption and partly for production may not matter so much if these are not the main categories changing at the margin. Similarly, if household labor supply is inelastic, then measures of marginal returns will not be very sensitive to how household labor is valued, even if average returns are.

<sup>8</sup> We do not perform sensitivity exercises for labor exchange and mark-to-market value in this paper since the data from the Townsend Thai Monthly Survey are not rich enough for these exercises.

Table 3 reports the enterprise income, assets, and rate of return (averaged over 84 months) for the median household in each region. At first glance and without further quantitative analysis, the table shows that different definitions result in a wide range of measured income, assets and associated rate of return. Median average enterprise income ranges from 2,063 to 10,046 baht per month for the central region, depending on the definition used. For the northeast, the range is from -573 to 2,677 baht per month. Similarly, the highest number for median asset size is twice as large as the smallest median size of assets in both regions (1,598 versus 780 thousand baht for the central region, and 539 versus 288 thousand baht for the northeast). The median ROA varies tremendously as a result, from 1.60% to 10.16% per year for the central region and from -1.80% to 9.96% per year for the northeast.

[INSERT: Table 3]

#### 4. Empirical Strategy

The objective of this paper is to study how different definitions of household enterprise income and assets affect the consequent rate of return on household enterprise assets. Our method starts with the calculation of various measures of income, assets and the resulting ROA. We then analyze how much each measurement of household enterprise ROA differs from each other measure, through pair-wise comparisons. In doing so, we calculate a normalized root mean square deviation (normalized RMSD) of ROA for each pair of ROA measurements for each household. Since household enterprise income and assets are the ingredients for the calculation of ROA, we also present the normalized RMSD for household enterprise income and assets to complement our main results for ROA.

Specifically, a normalized RMSD is defined for each household  $i$  as

$$Normalized\ RMSD_{m,n,i} = \frac{\sqrt{\frac{\sum_{t=1}^T (X_{m,i,t} - X_{n,i,t})^2}{T}}}{\bar{X}_{n,i}}$$

where  $X$  is household  $i$ 's income, assets, or ROA;  $m$  and  $n$  denote two different measures of  $X$ ; and  $T$  is the total number of periods in the analysis. The root mean square deviation therefore measures the magnitude of the deviation between two measures of income, assets, or ROA. In order to compare across household enterprises and various definitions, we normalize the RMSD by the mean of a benchmark definition of income, assets, or ROA ( $\bar{X}_{n,i}$ ), respectively. The interpretation of the magnitude of the normalized RMSD is similar to the interpretation of the coefficient of variation. If the normalized RMSD is equal to  $z$ , we say that the deviation between  $X_m$  and  $X_n$  (in a root mean squared sense) is  $z \times 100\%$  as compared to the mean of  $X_n$ . This is the way we quantify what matters and what does not (or matters much less).<sup>9</sup>

One advantage of the normalized RMSD used in this paper is that it is rank-order preserving regardless of the choice of the benchmark measurement. For example, let's start by varying the numerator, i.e. the income component of ROA, assumed that we would like to analyze the sensitivity of household consumption ( $H$ ) on that enterprise income. Concentrating on income alone, if we pick  $X1$  as our benchmark income, the corresponding alternative income is defined as  $X1+H$ . By construction, the deviation between the benchmark and the alternative income will be  $(X1+H) - X1 = H$ . If we pick  $X2$  as the benchmark instead, we can redefine the new alternative income as  $X2+H$  accordingly. As a result, the deviation between the benchmark and the alternative income will again equal to  $H$ . The resulting RMSD will be identical regardless of our choice of the benchmark income. Since the means of  $X1$  and  $X2$  are different, the calculated normalized RMSD using  $X1$  and  $X2$  will not be the same. However, in the sensitivity analysis when we compare across various aspects of income measurement for a given benchmark, the rank orders of the normalized RMSD will be identical regardless of the choice of that benchmark, as that only changes the scale. A similar argument for rank-order preserving applies to the normalized RMSD of assets alone, and in the end to the normalized RMSD of ROA, our variable of interest. The only caveat is that in varying the assets, i.e. the denominator of ROA when changing the benchmark, the relationship is no longer exactly linear. This (quasi) rank-order preserving property is important as it allows us to study the *relative* sensitivity of different

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<sup>9</sup> Note that we also analyze the co-movement between each pair of measures of income, assets, or ROA by computing their pair-wise correlation coefficients. The overall conclusion is similar to what we get from the normalized RMSD and the results are not reported here to save space.



aspects of the measurement of household enterprise income, assets, and ROA without knowing the exact true values of these variables and regardless of which benchmark to use.

Specifically, in this paper we present the pairwise normalized RMSD of income, assets, and ROA when we use the definition for ROA 1 as our benchmark. We do not claim that ROA 1 is the ideal definition of household enterprise ROA. In fact, it is not. For example, as discussed in the Appendix, Assets 1 include all fixed assets surveyed in the Agricultural Assets, Business Assets, Livestock Inventories, Household Assets, and Land Modules of the Townsend Thai Monthly Survey. In the Household Assets Module, the assets include cars, pick-up trucks, long-tail boats with motors, large fishing boats, and motorcycles, among others. Although these assets are listed and reported in the Household Assets Module, they are likely to be used in production activities of the household enterprise for many households. In practice, one could envision looking at each household and classifying or apportioning each asset of the household based on its use, i.e. allowing for the distinction between household assets versus business assets to vary with the household. With a large number of household observations, this exercise would be quite demanding on enumerators and may introduce substantial errors. In any event, it is not how the Townsend Thai Monthly Survey was originally conducted. Therefore we include all of the fixed assets listed in any modules of the survey in the definition of Assets 1, for all households and for all periods. We will then return to this issue in Section 5.1.4 when we perform the sensitivity analysis on ROA assuming as an alternative that a part of these assets was used for consumption purposes.

## **5. Results**

Table 4 presents the medians of the normalized RMSD of various incomes (Panel A), assets (Panel B), and their corresponding ROA (Panel C). The normalized RMSDs are compared to the income, assets, and ROA as defined for ROA 1. Although we will focus our discussion in this section based on Panel C of Table 4, we note that, as expected, the ranking of the normalized RMSD for enterprise income, when available, is the same as the ranking for enterprise ROA. A similar conclusion applies to the normalized RMSDs for enterprise assets and for enterprise ROA.

[INSERT: Table 4]

## ***5.1 Distinguishing Household Enterprise from the Household***

### ***5.1.1 Labor Income***

We calculate the normalized RMSD between ROA 1 and ROA 2, where we deliberately do not adjust for household labor in the income of the household. The result reported in Table 4 shows that the normalized RMSD is very high in both central (2.50) and northeastern regions (8.00). The magnitudes of the RMSDs are the second highest among all ROAs we consider in this paper (after ROA 8 which uses cash income rather than accrued income). A possible explanation for the large discrepancy is that we may overestimate the value of imputed labor income, and thus subtract too much implicit household labor cost from the household enterprises. For example, the marginal product of labor for household members working in household enterprise might be lower than the wage rate we observed in external labor markets. Additionally, household members may over-report their time spent on household enterprise production, which is especially probable in the presence of underemployment in a developing economy. The findings also reveal that the normalized RMSD is higher in the northeast than in the central region. In other words, household labor seems to matter more as compared to the central region. An explanation is that households in the northeast are mainly in cultivation, which is more labor-intensive than retail businesses in the central region.

Since the high values of the normalized RMSD could be from the errors discussed above as well as other errors from ad hoc assumptions made in the wage imputation exercise, we further perform sensitivity analysis by deliberately adjusting downward our calculated imputed labor compensation by 25%. The normalized RMSDs are smaller for both regions, but are still large (1.53 for the central region and 4.89 for the northeast). If we are more extreme and adjust the calculated imputed labor compensation downward by 50%, the normalized RMSDs become much smaller (0.81 and 2.14 for the central and the northeastern regions, respectively), but they

are still ranked in the top fourth for central region and the top third for the northeast among various measures of income and assets in our list.

#### *5.1.2 Consumption of Household's Own Outputs*

Table 4 also shows the sensitivity of consumption of household's own outputs, comparing ROA 3 against ROA 1. The results lead to the conclusion that this issue seems to be minimal as compared to other issues considered in this paper, although the sensitivity is again higher for the households in the northeast (1.20) than those in the central region (0.13). An explanation is that the average consumption of household-produced outputs is higher for the northeastern households, resulting from rice cultivation as the main occupation in the region. Note again, however, that the inclusion or exclusion of owner-produced consumption does impact measured income substantially, in absolute orders of magnitude, as reflected in Table 3.

#### *5.1.3 Utility Expenses*

To analyze how sensitive enterprise income is with regard to the way we treat common expenses of the household and its enterprise, we focus on one of the main joint expenses of the household, namely utility bills. In this exercise, we compute household enterprise income that does not treat utility spending as a cost of production to compute ROA 4 and then compute the RMSD between ROA 4 and ROA 1. Utility expenses include electricity, gas, water, telephone and other communication services. Table 3 shows that the deviation between these two alternative definitions of income is relatively small when we compared them to other deviations considered in this paper. Hence the normalized RMSD reported in Table 4 ranks seventh out of nine for the central region and eighth for the northeast. The findings suggest that income and ROA of household enterprises in the Townsend Thai Monthly Survey are not overly sensitive to the treatment of utility expenses.

We emphasize that the treatments of utility expenses in both ROA 1 and ROA 4 are not ideal. Each represents an extreme assumption that apportions 100% of utility expenses to either the enterprise's production activity or the household's consumption activity. However, the overall

conclusion from our sample is that even with this maximum difference in the way we treat utility expenses, it does not seem to matter as much as the change in other definitions of income or assets. One of the explanations for this finding is that most firms in the sample are not heavy manufacturing firms. We would expect this adjustment to matter much more for firms that use substantial electricity in production.

#### *5.1.4 Household Fixed Assets*

Due to the difficulty in classification of a household asset by its uses (for consumption versus production purposes), we initially assign them to the enterprise assets when we compute ROA 1. In this section, we return to this issue and perform two sensitivity analyses. First, we compute ROA 5 by adjusting the enterprise income so that it includes the consumption service flows of household fixed assets similar to the way we treat consumption of the household's own outputs in ROA 3. We assume that these additional monthly consumption service flows are equal to 1.67% of the value of the household fixed assets (excluding land). This assumption implies a service flow of approximately 20% for household fixed assets per year, which is equal to the depreciation rate generally applied to fixed assets in Thailand.<sup>10</sup> For both regions, the normalized RMSDs are very close to zero, suggesting that this issue is unimportant relative to the other issues considered in this paper.

In the second sensitivity exercise, we compute ROA 6 by adjusting the assets (the denominator of ROA) instead of the enterprise income (the numerator). In this case, we deliberately exclude all assets recorded in the household fixed assets module from the calculation of ROA. The normalized RMSD between ROA 6 and ROA 1 ranks fifth among nine comparisons in this paper for both regions. This finding suggests that treatment of household fixed assets in the calculation of household enterprise ROA matters to some extent. Again, the magnitude of the normalized RMSD seems to be higher for the northeast than the central region, even though the percentage of household fixed assets (as compared to total fixed assets) is slightly higher in the central region (15.90%) than the northeast (14.86%). The explanation is that the enterprise income of

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<sup>10</sup> According to the 1984 Royal Decree by the Revenue Department of the Ministry of Commerce, depreciation of fixed assets ranges from 5% (buildings) to 20% (any assets except for land and commodities) per year.

households in the central region is much higher than the northeast. It is not surprising that ROA is more sensitive to the treatment of assets, in the denominator, for the households with lower income, in the numerator.

## ***5.2 Non-Factor Income***

We calculate ROA 7 using the household enterprise income that includes gifts and transfers as a part of the income.<sup>11</sup> The median normalized RMSD as compared to ROA 1 shows that this alternative definition of income creates a large deviation for the northeastern region (2.64). The sensitivity ranks third among the nine exercises performed in this paper. The normalized RMSD in the northeast is much higher than in the central region (0.44), which ranks fifth. An explanation is that households in the northeast have denser social networks than the central region. For example, 84% of households in the northeast have at least one extended family living in the same village, as compared to 64% for the central region. Also, the median number of extended families living in the same village of a household in the northeast is 3 families, while the median is 2 for the central region, as reported in Table 1. As a result, the average net gifts and transfers received by the households in the northeast were quite large relative to average household income. Households in the northeast are also poorer than the households in the central region and are more likely to receive transfers from the government.

## ***5.3 Timing and Frequency***

Next, we compute ROA 8 using the cash flow from household enterprise production activities instead of the accrued income of the enterprise. We nevertheless adjust the simple cash flow to take into account some non-cash transactions between the household and its business enterprise (household's own labor and consumption of household's own labor) in the same way we did with ROA 1, so that the only difference between ROA 1 and ROA 8 lies in the timing mismatch between expenses on inputs and revenue from outputs. Table 4 shows that the normalized RMSD is quite high for both central and northeastern regions. In fact, among all nine sensitivity

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<sup>11</sup> In effect, while inputs received as gifts are treated as costs of production in the income for ROA 1, input gifts are not treated as costs of production and not subtracted from revenue in ROA 7.

exercises performed in this paper, the RMSD from this exercise is the highest for both regions. The normalized RMSD for the northeast (9.71) is also larger than the RMSD of households in the central region (3.26). An explanation is that the main occupation in the northeast is cultivation. Thus, production activity in these households spans over longer periods and inventories play a crucial role in liquidity management.

One would guess that the difference between cash and accrued income should be smaller for a less frequent panel data. This is in fact what we find. When we consider an annual measure of enterprise accrued income and cash income (by summing up consecutive monthly accrued income and cash flows), the issue seems less acute as we move from higher (monthly) to lower (annual) frequency. This is shown rather dramatically in Figure 1. The normalized RMSD declines for both regions when the frequency is lower. However, even in the annual data, the choice of accrued versus cash income still matters as reflected in the RMSD higher than zero (0.79 for the central region and 2.45 for the northeast), especially in the agricultural northeastern region. In sum, the discrepancy in each region puts cash versus accrual high on the list of priority issues, despite the annualized data.

[INSERT: Figure 1]

We explore further why RMSD is still much higher than zero even when we consider the annual data by adjusting for an additional difference between the accrued income and cash income, namely depreciation of fixed assets and unrealized capital gains and losses. These items are a part of accrued income even though there is no cash involved. After adjusting for the depreciation and unrealized capital gains and losses, the normalized RMSD for the annualized data drops further for both regions (to 0.78 for the central region, and to 2.27 for the northeast). The remaining difference is only from changes in trade credits (account receivables and account payables) and inventories. This finding suggests first, that close attention be paid to gains and losses; and that, second, even with the annualized data, trade credits and inventories may not be canceled out over time, though this is a less salient issue than some of the others. One possible explanation is that the enterprise accumulates or decumulates net trade credits and inventories over time. This could be due to business expansion or changes in its working capital

management strategy. For example, the enterprise could extend or shorten the payment periods of its trade credits. Likewise, it could accumulate or decumulate the average holding of its inventory stocks.

#### ***5.4 Various Types of Assets***

Next, we explore different measures of enterprise assets. In ROA 1, we define enterprise assets as fixed assets only. In ROA 9, we expand the definition of enterprise assets to include working capital (i.e. account receivables, account payables, and inventories). In ROA 10 we further expand the definition to include cash and other financial assets. By construction, the normalized RMSD is larger for ROA 10 than ROA 9. Including or excluding working capital does not seem to affect the enterprise's ROA much. The normalized RMSD for ROA 9 ranks sixth for the central region and seventh for the northeast. The sensitivity for the treatment of financial assets is larger, with the normalized RMSD ranked fourth in the northeast and third in the central region. Again, note that the sensitivity of enterprise ROA with regard to the various definitions of enterprise assets is stronger in the northeast than the central region since enterprise income in the northeast is lower than income in the central region.

#### ***5.5 Summary of the Findings***

Our sensitivity analysis has provided interesting results. First, the findings from our sampled households in the Townsend Thai Monthly Survey suggest that the three issues that lead to the most sensitivity of measured household enterprise ROA are the choice of accrual versus cash basis of income, the treatment of household's own labor in enterprise income and, especially for the northeastern region, the treatment of non-factor income. Other issues that matter but to a lesser extent, relatively speaking, include the treatment of financial assets and working capital, the treatment of household fixed assets jointly used for both consumption and production purposes, the treatment of common utility expenses, and the treatment of consumption of household's own outputs. The treatment of gifts and transfers is relatively more sensitive in the region with dense social networks. For other sensitivity exercises, the relative ranking is similar for enterprises in both the less agricultural, semi-urban, relatively richer region and the mostly

agricultural, rural, relatively poorer region. Second, although the overall ranking of the sensitivity is similar for both regions, the magnitude of the sensitivity is higher for the relatively poor region dominated by crop cultivation rather than the richer region with non-farm enterprises. Finally, although the choice between accrued income and cash income matters most among various sensitivity exercises performed in this paper, the issue matter less when the frequency of the data declines. However, even with annual data, the choice between these two concepts of income still matters, plausibly due to either the expansion of the business enterprises or the change in their working capital management strategy.

## **6. Suggestions for Future Surveys**

Time and financial resources impose a constraint on the detail of the survey questionnaires. As mentioned earlier, although many of the issues discussed in this paper are well-known among researchers fielding and using household and enterprise surveys in developing countries, it is unclear which issues matters most, and for what types of the households, in the measurement of household enterprise ROA. This paper takes advantage of the wealth of information from the Townsend Thai Monthly Survey, which contains detailed questions that allow us to perform sensitivity analysis with the data. We calculate various estimates of household ROA under different definitions of income and assets, and analyze how much each of the definitions matters for the estimates of household enterprise ROA. The findings in this paper yield important information that may benefit researchers conducting surveys in developing economies. We outline here some suggestions for future household and enterprise surveys that aim at the study of household enterprise performance. (Note that as ROA is computed from income and assets, our discussion could be extended to the study of household enterprise income or assets in addition to the study of return to household enterprise as well.)

In general, we stress that clarity of the definitions of enterprise income and assets are crucial. We argue that this clarity is important for any household and enterprise surveys regardless of its length, the level of detail or the number of the questions in the questionnaires. Although detailed questionnaires can be used to ask for more precise information, they still sometimes fail to ask some critical questions and there is room for improvement. For short questionnaires that ask for



aggregate numbers rather than the components separately, it is essential that the field enumerators and the respondents understand correctly the intent of the questionnaire designers.<sup>12</sup> Likewise, clear questions in turn help researchers understand correctly what the respondents mean in the answers.

Of course, the choice of measurement of household enterprise income and ROA depends on the purpose of individual research. We show that various definitions could lead to significant difference in the measurement of household enterprise income and, in the end, ROA. As the findings from this paper suggest that three issues are of particular importance, we further address some suggestions related to them in more detail here. First, if a survey is high frequency, the distinction between accrued income and cash income is crucial. The income calculated from these two different approaches could yield very different numbers. For a survey with lower frequency, this issue still matters, although at a lesser extent. If this issue is of importance for researchers, the design of survey questionnaires should ask for information that captures the changes in working capital (account receivables, account payables, and inventories) of the enterprise, as well as other non-cash transactions (depreciation, unrealized capital gains and losses, and consumption of household's own outputs, among others). The responses to these questions will allow the researcher to distinguish accrued income from cash income.

For a survey with detailed questionnaires (e.g. those similar to the LSMS surveys), the survey should not equate the acquisition of inputs with the use of inputs, and not equate the disposal of outputs with the production of outputs. These transactions could be different if inventory management plays an important role in the enterprise's strategy. Similarly, the survey should not equate the purchase of the inputs with the cost of inputs, nor equate the sales of the outputs with the revenues of the enterprise. These items could be different if the enterprise relies on trade credits.

For a short survey that asks only few questions about household enterprise's aggregate income, in addition to directly asking for the enterprise cash profits (total revenue and total cost), the survey should also ask for the change in value of account receivables and account payables, and

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<sup>12</sup> See, for example, the question in de Mel, McKenzie, and Woodruff (2009) we quoted in Section 2.1.1.

the change in value of inventories (as well as other non-cash transactions such as the consumption of household's own outputs).

Second, researchers who are interested in studying the income and performance of household enterprise may want to pay more attention to the household's own labor inputs. Many surveys already do a careful job in asking detailed questions on household labor, especially the time spent by each household member on the household's own farm and non-farm business enterprises. However, the surveys generally do not ask for the implicit compensation to this household labor. Although not ideal, a survey may ask additional questions that allow researchers to better calculate the cost of household labor. For example, the question could be "How much would [each household member] earn if he/she performed this task for other business outside the household?" Alternatively, the survey may ask "How much would the household enterprise have to pay for someone outside the household to perform the task currently done by [each household member]?" Obviously, these two questions are not ideal and do not necessary yield the same answer, but this additional information would be useful.

Third, gifts and transfers are important in developing economies, especially those with dense social capital and widespread social welfare programs from the government. For a survey with detailed questionnaires, the survey may ask explicitly the quantity and the value of the outputs given to others without being paid. Similarly, the survey may elicit explicitly the quantity and the value of the inputs given to the household for free, either from other households or from the government. For a short survey, it should be clear when asking about the enterprise's outputs (or revenues) whether they include those given away to others (without being paid). Similarly, it should be clear when asking about the enterprise inputs (or costs) whether they include those received from others without paying.

For surveys in an economy with dense social networks, researchers should also pay special attention to free labor and labor exchange. For a survey with detailed questionnaires, in addition to asking about the number of days (or hours) of work provided by outsiders without paying for compensation, the survey should ask for the value of the labor service. For each of the free labor provided to the household enterprise by an outsider, a questionnaire may ask "How much would

you have to pay if you had to pay for someone else to perform the task?”. Alternatively, the question could be “How much would [each outsider] get paid if he/she performed the same task elsewhere?”.

Finally, we remind our readers again that our data from the Townsend Thai Monthly Survey are not rich enough to allow us to perform the sensitivity analysis for labor exchange and mark-to-market valuation of assets. This is not meant to imply that these issues are not relevant or unimportant. We leave the exploration on how they affect the measurement of household enterprise rate of return to future research.

## **Appendix: Detailed Definitions and Construction of Income and Assets**

### ***A.1 Income***

*Income 1:* Income 1 is an accrued enterprise income, which is the difference between the enterprise total revenue and the associated cost of inputs used in generating that revenue. Revenue is realized at the time of sales or disposal. Associated cost could be incurred in the periods different from the sales or disposal of outputs. Total revenue includes the value of all outputs the household produces for sale (in cash, in kind, or on credit), own consumption, or giving away. Revenue also includes rental income from fixed assets. Revenue does not include the wages earned outside the household or gifts and transfers received by the household. Cost includes the value of inputs used in the production of the outputs, regardless of the method of their acquisition, i.e. purchase (in cash, in kind, or on credit), gifts from others or transfers from government. Cost includes the wage paid to labor provided by non-household members as well as (imputed) compensation to the labor provided by household members. Cost includes all utility expenses of the household regardless of the purposes of their uses. Cost also includes depreciation of fixed assets.

In order to impute the cost of the household's own labor, we follow the procedure described in Townsend and Yamada (2008). First, the method is relatively straightforward for a household member who earns labor income from the labor markets virtually every month. In this case, we use the observed wage rate for each of these household members. Together with the survey data regarding time spent on home production activities, we calculate the shadow compensation the household member would have received from providing labor to production activities operated by the household. Second, the procedure becomes more complicated when household members do not work in the labor market every month and we observe their monthly market wage rate only in some months but not others. In this case, we interpolate the shadow wage rate for each household member based on the member's own observed market wages, and adjust for an age and, province-specific time trend, and monthly cyclical fluctuations. The adjustment factors are computed from the simple Mincerian regression using all sampled individuals who earned observable wages. Finally, the most complicated procedure involves household members who never work in the external labor market throughout the sample period. In this case, we impute the member's shadow wage rate from individual characteristics, together with calendar month and year fixed effects. We use the Heckman two-step estimation to address the self-selection decision into household activities versus external labor market. In the first step, the selection equation is estimated using probit estimation. We include only people who never worked in the external market and people who never work in the household enterprise in the sample. The exclusion restrictions are (a) (logarithm of) non-labor assets, and

(b) various demographic characteristics of the households, which are commonly used in the labor literature in developed countries. The regression coefficient for non-labor assets is strongly negative. The coefficients for demographic variables are as expected, e.g. positive for male dummy, positive for age and negative for age-squared, with other results reported in Townsend and Yamada (2008). The explanatory variables in the second stage regression (the wage regression) include household demography, educational attainment, province dummies, calendar month dummies, province-specific time trends, sector dummies, and polynomial of propensity scores. The regression coefficients have expected signs, again with results reported in Townsend and Yamada (2008). The overall mean imputed wage rate ranges from 10.57 (for individuals with lowest education) to 27.76 (for individuals with highest education) baht per hour. For comparison, the overall mean observed wage rate ranges from 19.18 to 58.32 baht per hour.

*Income 2:* Income 2 is household income, and is calculated as Income 1 plus total compensation to household labor. Compensation to household labor includes both wages earned in external labor markets (including pension) and shadow earnings compensated to household labor supplied to its own enterprises. The shadow wages are imputed as described earlier for the cost definition of Income 1. In this paper, labor income also includes pensions, although one might envision that pension is an accrued income compensated to the labor input provided in earlier periods.

*Income 3:* Same as Income 1, but we exclude household consumption of its own outputs in the revenue calculation.

*Income 4:* Income 4 is the same as Income 1 except that we do not include any utility expenses in the cost of production of the enterprise.

*Income 5:* Income 5 is the same as Income 1, except that we add service flows from household fixed assets. The service flows is assumed to be 20% of the value of household fixed assets. Household fixed assets are the assets included in the Household Assets Module of the Townsend Thai Monthly Survey, namely, car, pick-up truck, long-tail boat with motor, large fishing boat, bicycle, air conditioner, regular telephone, cellular telephone, refrigerator, sewing machine, washing machine, electric iron, gas stove, electric cooking pot, sofa, television, stereo, and VCR.

*Income 6:* Income 6 is the same as Income 1.

*Income 7:* For Income 7, we add non-factor income to the definition of Income 1. We define non-factor income of a household enterprise as gifts that were explicitly stated as inputs of production in production modules of the Townsend Thai Monthly Survey (Cultivation, Fish and Shrimp, Livestock Inventories, Livestock Activities, and Business Modules). Gifts and transfers for non-enterprise purposes (such as consumption or education scholarship) are not included in Income 7.

*Income 8:* Income 8 is defined as the cash income of household enterprise. The cash income is the difference between the cash inflows from production activities and the cash outflows from production activities. Cash inflows include revenues from sales of outputs for cash or in kind, but exclude sales on credits. In order to separate cash flows of household enterprise from the household cash flows, we adjust cash flows from production activities in two ways. First, we include household consumption of its own outputs to the cash inflows for household enterprise, as if the household sold the outputs in the market and repurchased them back. Second, we add the imputed household's own labor provided to household enterprise (as defined and described earlier in Income 1 section) to the enterprise's cash outflows, as if the enterprise hired the household members to work on the business.

*Income 9:* Income 9 is the same as Income 1.

*Income 10:* Income 10 is defined as Income 1 plus net interest income, i.e. compensation to household's financial assets.

## ***A.2 Assets***

*Asset 1:* Assets 1 include all *fixed* assets surveyed in the Agricultural Assets, Business Assets, Livestock, Household Assets, and Land Modules of the Townsend Thai Monthly Survey. In the Agricultural Assets Module, fixed assets include walking tractor, large four-wheel tractor, small four-wheel tractor, aerator, machine to put in seeds and pesticides for preventing grass, machine to mix fertilizer and soil, sprinkler, threshing machine, rice mill, water pump, rice storage building, other crop storage building, large chicken coop, other buildings for livestock, and other buildings. In the Livestock Inventory Module, assets include young meat cow, mature meat cow, young daily cow, mature daily cow, young buffalo, mature buffalo, young pig, mature pig, chicken, and duck. In the Household Assets Module, assets include car, pick-up truck, long-tail boat with motor, large fishing boat, bicycle, air conditioner, regular telephone, cellular telephone, refrigerator, sewing machine, washing machine, electric iron, gas stove, electric cooking pot, sofa, television, stereo, and VCR. Due to the variety in non-agricultural businesses, in the Business

Module, we do not list specific name of the assets, but instead ask the household to report the fixed assets they use in their business enterprises. In the Land Module, assets include land (at acquisition value), buildings, the value of land and building improvement, and the appreciation of land when major events occurred (such as an addition of new public roads). In all of the modules, assets that are not explicitly listed but have value more than 2,000 baht are also asked and included.

*Assets 2, 3, 4, and 5:* These definitions of household enterprise assets are the same as Assets 1.

*Assets 6:* Assets 6 is defined as Assets 1, but included assets listed in the Household Assets Module. Specifically, we do not include car, pick-up truck, long-tail boat with motor, large fishing boat, bicycle, air conditioner, regular telephone, cellular telephone, refrigerator, sewing machine, washing machine, electric iron, gas stove, electric cooking pot, sofa, television, stereo, and VCR.

*Assets 7 and 8:* These definitions of household enterprise assets are the same as Assets 1.

*Assets 9:* Assets 9 is defined as total fixed assets plus working capital. Specifically, they include all fixed assets defined in Assets 1, plus inventories and account receivables, and minus account payables from all business enterprises. For manufacturing and agricultural enterprises, inventories include all raw materials, work-in-progress inventories, and finished-good inventories. For retail business enterprises, inventories also include goods for resale.

## References

- Banerjee, Abhijit, and Esther Duflo. 2005. "Growth Theory through the Lens of Development Economics," in *Handbook of Economic Growth*, Philippe Aghion and Steven Durlauf, eds. Amsterdam: Elsevier Press.
- Beegle, Kathleen; Joachim de Weerd; Jed Friedman; and John Gibson. 2009. "Measuring Household Consumption: An Experiment in Tanzania," Working Paper.
- De Mel, Suresh; David J. McKenzie; and Christopher Woodruff. 2009. "Measuring Microenterprise Profits: Don't Ask How the Sausage Is Made," *Journal of Development Economics* 88: 19–31.
- Dillon, Andrew; Elena Bardasi; Kathleen Beegle; and Pieter M. Serneels. 2010. "Explaining Variation in Child Labor Statistics," IZA Discussion Paper No. 5156.
- Deaton, Angus. 1997. *The Analysis of Household Surveys*. Baltimore: The Johns Hopkins University Press.
- Duflo, Esther; Michael Kremer; and Jonathan Robinson. 2008. "How High Are Rates of Return to Fertilizer? Evidence from Field Experiments in Kenya," Working Paper.
- Grosh, Margaret and Paul Glewwe, eds. 2000. *Designing Household Questionnaires for Developing Countries: Lessons from Fifteen Years of the Living Standard Measurement Study*, Vol. 1–3. Washington, DC: World Bank.
- Hart, Oliver. 1995. *Firm, Contracts, and Financial Structure*. Oxford: Clarendon Press.
- Kremer, Michael Kremer; Jean N. Lee; and Jonathan M. Robinson. 2008. "The Return to Capital for Small Retailers in Kenya: Evidence from Inventories," Working Paper.
- McKenzie, David and Christopher Woodruff. 2008. "Experimental Evidence on Returns to Capital and Access to Finance in Mexico", *World Bank Economic Review*, 22(3): 457-82.



Morduch, Jonathan. 1999. "The Microfinance Promise", *Journal of Economic Literature* 37: 1569-1614.

Samphantharak, Krislert, and Robert M. Townsend. 2010. *Households as Corporate Firms: An Analysis of Household Finance Using Integrated Household Surveys and Corporate Financial Accounting*, Cambridge: Cambridge University Press.

Townsend, Robert M. and Hiroyuki Yamada. 2008. "The Summary of the Monthly Household Survey of Thailand on Labor Issues," unpublished manuscript, University of Chicago.

Udry, Christopher and Santosh Anagol. 2006. "The Return to Capital in Ghana," *American Economic Review*, Vol. 96(2), pages 388-393.

Vijverberg, Wim P.M. and Donald C. Mead. 2000. "Household Enterprises," in M. Grosh and P. Glewwe, eds. *Designing Household Questionnaires for Developing Countries: Lessons from Fifteen Years of the Living Standard Measurement Study*, Vol. 2: 105–138. Washington, DC: World Bank.

**Table 1 Household Characteristics by Region (Median Household)**

	Central	Northeast
Average Household Size	4.6	4.5
Average Number of Males	2.0	2.0
Average Number of Females	2.5	2.4
Network Density	2	3
Average Age of Household Members	37.50	33.05
Average Years of Education of Household Members	4.35	3.63
Average fraction of Time Spent on Cultivation Activity	0.31	0.61
Initial Assets	1,341,420	480,206
Initial Wealth	1,233,467	447,414
Average Household Income (Monthly, per capita)	2,175	605
Number of Households	259	237

**Remarks:** For each characteristics, we first compute an average over the 84 months for each household. Then, we compute, and present in this table, the median among the households in each region. The exchange rate has changed over time during the survey period. The exchange rate was approximately 36–37 THB per US dollar at the starting point of our data in January 1999. The exchange rate fluctuated to around 36 to 42 THB per US dollar from January 1999 to December 2005. At the time we write this mono- graph (November 2008), the exchange rate is approximately 30 THB per US dollar. Given these exchange rate fluctuations, we report only the value in local currency (baht) in the rest of this paper.

**Table 2 Various Definitions of Income and Assets Used in the Analysis**

	<b>Definition of Income</b>	<b>Definition of Assets</b>
ROA 1	<i>Income 1:</i> Accrued enterprise income, which is the difference between the enterprise revenue and the associated cost of inputs used in generating that revenue. Revenue includes the value of all outputs the household produces for sale, own consumption, or giving away, as well as rental income from fixed assets. Revenue does not include the wages earned outside the household or gifts and transfers received by the household. Cost includes (imputed) compensation to the labor provided by household members, all utility expenses of the household, and depreciation of assets.	<i>Assets 1:</i> All fixed assets recorded in Agricultural Assets, Business Assets, Livestock Inventories, Household Assets, and Land Modules in the Townsend Thai Monthly Survey.
ROA 2	<i>Income 2:</i> Same as Income 1, but including total compensation of household labor in total revenue.	<i>Assets 2:</i> Same as Assets 1.
ROA 3	<i>Income 3:</i> Same as Income 1, but excluding household consumption of its own outputs.	<i>Assets 3:</i> Same as Assets 1.
ROA 4	<i>Income 4:</i> Same as Income 1, but excluding total utility expenses.	<i>Assets 4:</i> Same as Assets 1.
ROA 5	<i>Income 5:</i> Same as Income 1, but adding the service flows from household fixed assets. The service flows is assumed to be 20% of the value of household fixed assets (excluding land).	<i>Assets 5:</i> Same as Assets 1.
ROA 6	<i>Income 6:</i> Same as Income 1.	<i>Assets 6:</i> Same as Assets 1, but do not include assets listed in the Household Assets Module in the Townsend Thai Monthly Survey.

ROA 7	<i>Income 7:</i> Same as Income 1, but including the net gifts and transfers received by the household.	<i>Assets 7:</i> Same as Assets 1.
ROA 8	<i>Income 8:</i> Cash income, which is the difference between the cash inflows from production activities and the cash outflows from production activities, but adding household consumption of its own outputs (as if they sold the outputs in the market and repurchased them back), and household's own labor.	<i>Assets 8:</i> Same as Assets 1.
ROA 9	<i>Income 9:</i> Same as Income 1.	<i>Assets 9:</i> Total fixed assets and working capital, i.e. assets defined in Assets 1, plus inventories and account receivables, and minus account payables.
ROA 10	<i>Income 10:</i> Same as Income 1, plus net interest income of household's financial assets.	<i>Assets 10:</i> Total assets, i.e. assets defined in Assets 9, plus financial assets.

**Remark:** The detailed description of each measurement is presented in the Appendix.

**Table 3 Various Measures of Enterprise Income, Assets, and Rate of Return by Region (Median Household)**

	<i>Panel A: Income</i>		<i>Panel B: Assets</i>		<i>Panel C: ROA</i>	
	Central	Northeast	Central	Northeast	Central	Northeast
ROA 1	2,520	266	1,024,624	376,263	2.31	0.87
ROA 2	10,059	2,680	1,024,624	376,263	10.18	9.94
ROA 3	2,022	-559	1,024,624	376,263	1.61	-1.81
ROA 4	3,447	429	1,024,624	376,263	2.81	1.52
ROA 5	2,654	348	1,024,624	376,263	2.42	1.07
ROA 6	2,520	266	783,752	287,781	2.52	0.83
ROA 7	4,084	1,314	1,024,624	376,263	4.48	4.47
ROA 8	4,928	1,520	1,024,624	376,263	5.01	4.36
ROA 9	2,520	266	1,097,659	417,314	2.29	0.91
ROA 10	2,520	266	1,597,762	538,842	1.74	0.73
No. of Households	259	237	259	237	259	237

**Remarks:** For each measurement of income, assets, and ROA, we first compute the mean over 84 months for each household.

**Table 4 Median Normalized RMSD of Income, Assets, and ROA**

	<i>Panel A: Income</i>		<i>Panel B: Assets</i>		<i>Panel C: ROA</i>	
	Central	Northeast	Central	Northeast	Central	Northeast
ROA 2	1.56	4.82	-	-	2.54	8.04
ROA 3	0.13	1.19	-	-	0.13	1.21
ROA 4	0.19	0.22	-	-	0.20	0.21
ROA 5	0.07	0.10	-	-	0.07	0.10
ROA 6	-	-	0.20	0.23	0.77	1.46
ROA 7	2.20	6.04	-	-	2.00	5.88
ROA 8	3.26	9.64	-	-	3.26	9.71
ROA 9	-	-	0.05	0.11	0.25	0.66
ROA 10	-	-	0.51	0.46	0.94	1.67
No. of Households	259	237	259	237	259	237

**Remarks:** Normalized RMSD's are compared to measurement for ROA 1 as defined in Table 2 and the Appendix. We first compute normalized RMSD for each measurement for each household, using the time-series data over 84 months. We then compute, and report in this table, the median normalized RMSD across households in each region.

**Figure 1: RMSD of Cash Income versus Accrued Income**

